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TWO NEW *SCAPHINOTUS* FROM ARKANSAS WITH NOTES ON OTHER ARKANSAS SPECIES (COLEOPTERA: CARABIDAE: CYCHRINI)[1,2]

ROBERT T. ALLEN AND C. E. CARLTON

Department of Entomology, University of Arkansas,
Fayetteville, Arkansas 72701

Abstract.—Two new ground beetles species in the tribe Cychrini are described from western Arkansas: *Scaphinotus* (s. str.) *parisiana* and *Scaphinotus* (*Nomaretus*) *infletus.* Distribution records within Arkansas are given for four additional cychrine species. A cladogram of relationships for the five known species in the subgenus *Nomaretus* is proposed.

A number of papers on the ground beetle tribe Cychrini, as it occurs in North America, have been published including the following: Valentine, 1935; Van Dyke, 1938; Bell, 1959; Ball, 1960, 1966; Gidaspow, 1973. These papers provide a working idea of the systematics and distribution of the cychrine fauna in North America: *Sphaeroderus* Dejean (6 species); *Cychrus* Fabricius (3 species); *Scaphinotus* Latreille (7 subgenera, 46 species).

There are two large cychrine faunas, one eastern and one western. One species, *Scaphinotus elevatus* (Fab.) ranges from the eastern to the western United States. Cychrines inhabiting the mid-continent, the Ozark-Ouachita highlands, have affinities with both the eastern and western fauna. Many cychrine species appear to be endemic to specific mountain tops or at least to specific mountain ranges. There is also a lowland fauna consisting of a number of distinct species in several subgenera in *Scaphinotus.*

In eastern North America there are a number of geographical areas that are important because of the endemic species that occur in specific habitats in these areas, e.g., the southern Appalachians (various papers in Holt, 1969), peninsular Florida (Howden, 1963), and the Ozark and Ouachita mountains, Robison and Smith (1982), to mention a few. The Ozark-Ouachita mountain uplift area of western Arkansas has yielded a significant number of new species in several insect groups, including the Trichoptera, Plecoptera, and Coleoptera (Robison and Smith, 1982). The new species described in this paper are presently known to occur only in western Arkansas.

The new species of *Scaphinotus* s. str. described in this paper seems to have its closest affinities with the previously described *S. unicolor* (Fab.). *Scaphinotus unicolor* along with *S. elevatus* was set apart from other *Scaphinotus* species in a key given by Van Dyke (1938). Van Dyke characterized these two species in couplet 5 of his key as follows: "Pronotum either dull and finely or coarsely rugose, not distinctly

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punctured, or smooth with coarse punctures limited to depression, reflexed side margins wide throughout; elytra with continuous and sharply defined striae and intervals, the strial punctures close together, the lateral margin at humeri very broadly reflexed, epipleura densely punctured and rugose; fourth antennal segment glabrous like preceding segments; male front tarsi less broad, segments never broader than long."

Using Van Dyke's key, the new *Scaphinotus* species described here would fall into the *unicolor-elevatus* couplet.

The classification and ancestral relationships of *Scaphinotus elevatus, S. unicolor,* and the two other eastern species in this subgenus, *S. viduus* (Dej.), *S. webbi* Bell, have been discussed by Bell (1959) and Ball (1966). When Bell described *S. webbi,* his comments pointed out many of the problems relevant to establishing clear relationships among the species. Bell noted that *S. webbi,* "combines the widely reflected prothoracic margins of *Scaphinotus* s. str. with the two pairs of marginal setae of the subgenus *Irichroa.*" *Irichroa* had been used as the subgenus of *S. viduus.* Thus the characters that had been used to separate the two subgenera *Scaphinotus* and *Irichroa* could no longer be used. Accordingly, *Irichroa* became a synonym of *Scaphinotus.* Bell also noted that the mixture of characters, external and aedeagal, shared by the different eastern species of *Scaphinotus* made it difficult to determine phylogenetic relationships.

Ball (1966), in his treatment of the western *Scaphinotus petersi* group, relegated the four eastern species of *Scaphinotus* to four different and distinct groups. Ball said "Bell (1959) implied that the four eastern species are phylogenetically about equidistant from one another. The classification presented here is consistent with this implication." We have also noted the characters mentioned by Bell and Ball and are also unable to suggest a cladistic (phylogenetic) interpretation. We defer proposing a cladogram of *Scaphinotus* relationships and will only add a new species to Ball's *unicolor* group.

The new *Nomaretus* being described in this paper, its characters, as well as the characters of previously described species, do indicate reliable cladistic relationships. These characters are discussed in detail in a subsequent section.

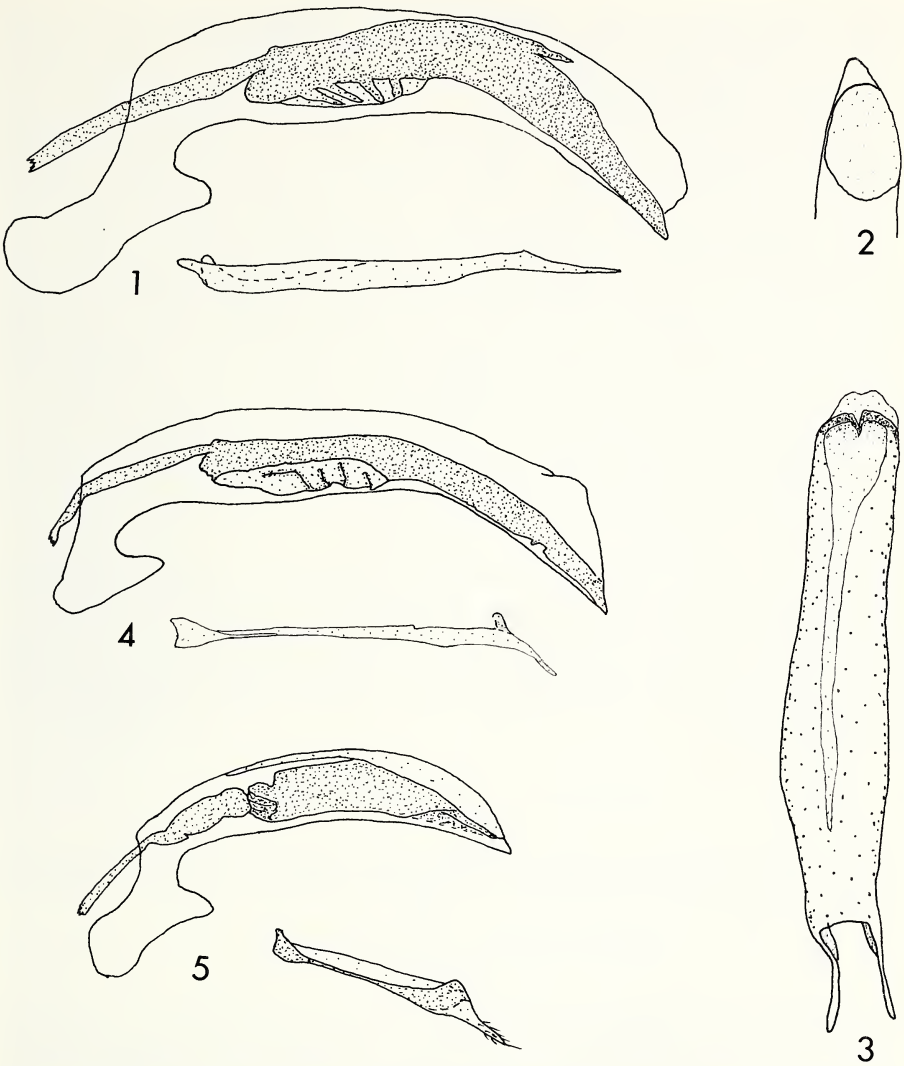
Scaphinotus (s. str.) **parisiana**, new species

Figs. 1, 2, 3

Holotype. ♂. Arkansas, Logan Co. 13 mi southwest of Paris, Northwest slope of Magazine Mountain, 26 June 1985. Robert T. Allen, Boyd Matthews, Andrew Wilbers, David Jackson, collectors (UAIC), 1♂ (George Ball, Univ. Alberta), 1♂ (American Museum Natural History), 1♂ (British Museum, Natural History).

Etymology. This species is named after the city of Paris, Arkansas, located at the base of Magazine Mountain where the species was first collected by the senior author.

Description. COLOR. Dorsal. Head: black. Pronotum: black to dark purple. Elytra: dark purple. Ventral. Entire surface: dull black. HEAD. Dorsal. Labrum: 4 (sometimes 3) setae in notch, 1 seta (each side) apically. Fronto-clypeal suture: distinct. Posterior: constricted behind the eyes. Supra-orbital setigerous punctures: 1 pair. Surface: microsculpture present or not, when present weak, isodiametric; impunctate. Ventral. Mentum: microsculpture, distinct, isodiametric; lateral lobes, broadly round-



Figs. 1–5. Male aedeagi. Figs. 1–3. *Scaphinotus parisiana*: 1. Right lateral. 2. Dorsal, apex. 3. Dorsal. Fig. 4. *Scaphinotus unicolor,* right lateral. Fig. 5. *Scaphinotus elevatus,* right lateral.

ed apically, distinctly margined anteriorly, less distinct laterally; tooth absent. Gular sutures: distinct. Palpi: as for the genus. Antennae: I–IV glabrous except for fixed setae; I unisetose, basal socket ball with distinct setae; II, asetose; III–IV, with scattered setae along the segment and a ring of apical setae; V–XI, pubescent. THORAX. Dorsal. Pronotum: microsculpture, where present, isodiametric; lateral margins distinctly and broadly reflexed; edge of lateral margins smooth their entire length, asetose. Surface: rugose and coarsely punctate except for small central discal area.

Median sulcus: distinct, other sulci absent. Ventral. Microsculpture: present, isodiametric. Prosternum: intercoxal process weakly margined apically; sparsely punctate near sternal-pleural margin. Proepisternum: sparsely punctate near episternal-epimeral suture. Proepimeron: sparsely punctate. Mesosternum: distinctly convex anteriorly, punctate, setose, with a median keel; posterior area distinctly margined laterally. Mesepimeron: punctate, rugose. Metasternum: punctate laterally. Metepisternum: punctate. Metepimeron: indistinct. ELYTRA. Microsculpture: absent on interval, weak in stria. Striae: distinct, 14–17, longitudinally confused laterally, distinctly punctate. Disk: asetose. Lateral margins: narrowly reflexed. Epipleura: coarsely punctate. Humeri: rounded. ABDOMEN. Microsculpture: present, isodiametric. Segments: I, coarsely punctate; II–III, punctate and rugose laterally; IV–VI, rugose laterally. LEGS. Protarsi: I–III, ventral pad present (I, apical ¼ only). Measurements. Length: 25–28 mm. Width: greatest width across elytra, 12–14 mm. AEDEAGUS (Figs. 1–3). Median lobe: cylindrical, basal lobes ⅓ length of median lobe. Parameres: elongate, distinctly narrowed distally, asetose. Internal sac: within median lobe extending posteriorly ¾ length of the median lobe, with ventral folds; median ejaculatory duct narrow at attachment with the internal sac; everted internal sac covered with small scales but no distinct spines or scale groups.

Comments. Scaphinotus parisiana is very similar to, and is apparently closely related to *S. unicolor.* The principle diagnostic character for *S. parisiana* is the greatly enlarged basal lobes of the median lobe. Specimens of *S. unicolor* were collected in the immediate vicinity of *S. parisiana,* and no specimens have been found that might be considered intermediates between the two aedeagal forms. This suggests that specimens referred to *S. parisiana* are in fact a valid new species, not one end of a range of variation.

Scaphinotus (s. str.) *unicolor* Fabricius
Fig. 4

Two specimens have been collected in Arkansas: Logan Co., near Paris, Magazine Mountain, 26 June 1985; Washington Co., pitfall trap, 1962.

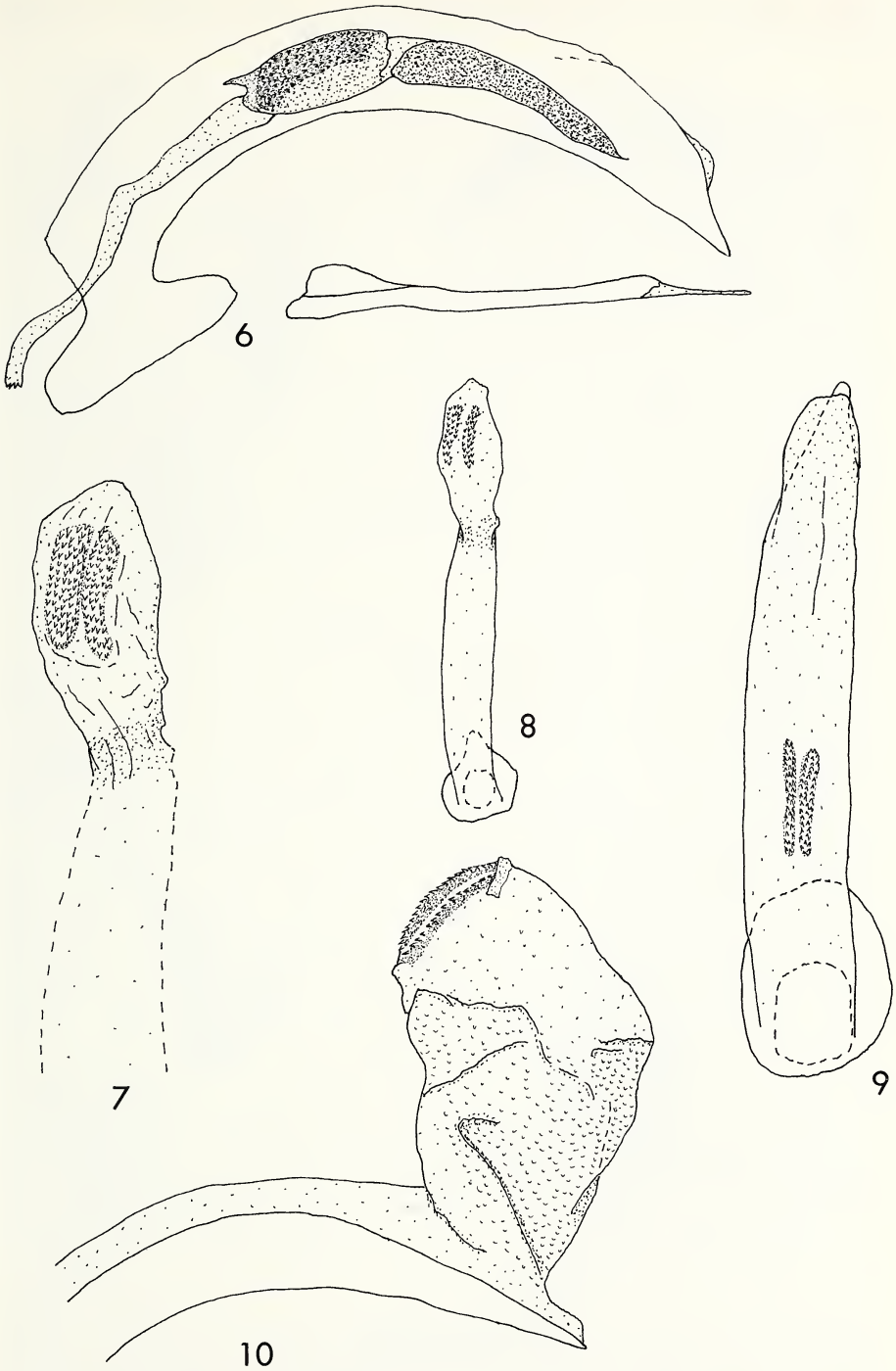
Scaphinotus (s. str.) *elevatus* Fabricius
Fig. 5

Scaphinotus elevatus seems to be the most common cychrine species in Arkansas. Collecting records include the following: Benton Co., Bentonville, Osage (one specimen each); Boone Co. (one specimen); Craighead Co. (one specimen); Searcy Co. (one specimen); Washington Co. (34 specimens). Specimens have been taken in all months from April through November.

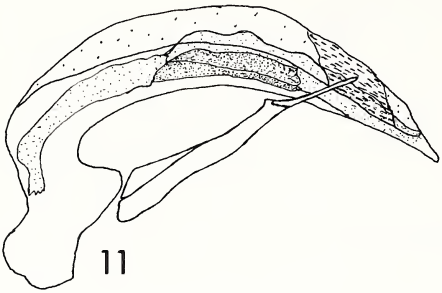
Scaphinotus (Nomaretus) infletus, new species
Figs. 6–10

Holotype. ♂. Arkansas, Newton Co., Alum Cove Scenic Area, 20 June 1974 (UAIC). Robert G. Chenowith collector.

Paratypes. 2♂♂ (UAIC), Newton Co., 5.9 mi S. Mt. Judea, Pitfall trap, 11 July 1974, colls. J. Heiss, R. Chenowith, R. Howard; Newton Co., Lost Valley State Park, 17 May 1973, coll. R. G. Thompson.



Figs. 6–10. Male aedeagi, *Scaphinotus* (*Nomaretus*) *infletus*: 6. Right lateral. 7. Dorsal, internal sac everted, enlarged. 8. Dorsal, internal sac everted distally, median lobe basally. 9. Dorsal, internal sac not everted. 10. Right lateral, internal sac everted.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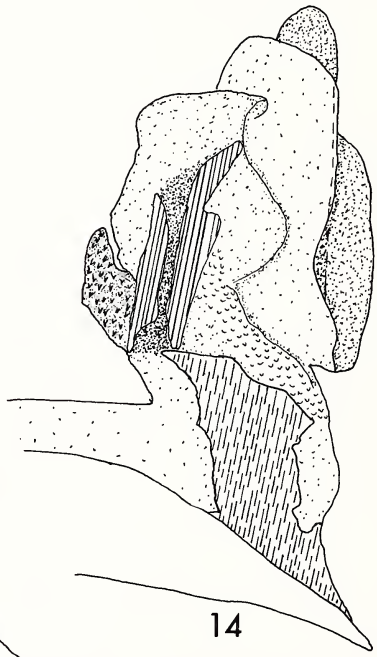
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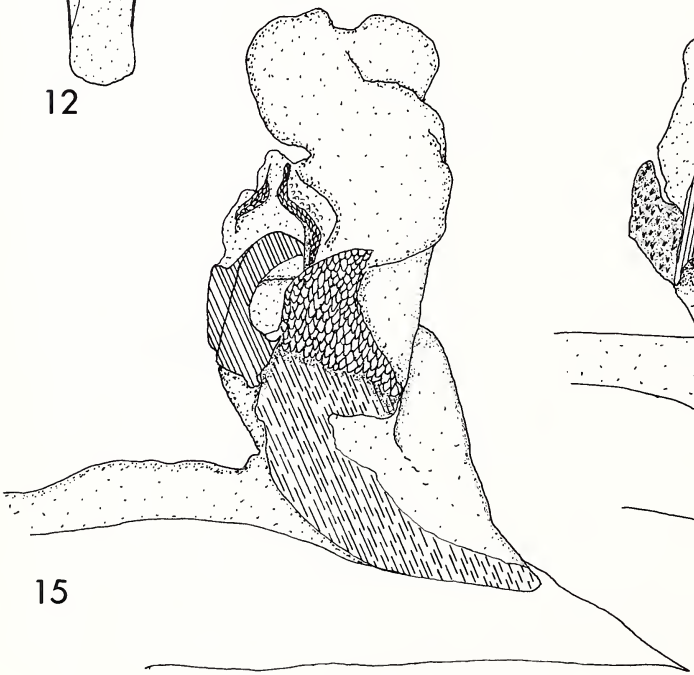
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Etymology. The specific name *infletus* means "the forgotten one."

Description. COLOR. Dorsal. Head, thorax: black. Elytra: black sometimes with a purple tint. Ventral. Entire surface black, sometimes shining. HEAD. Dorsal. Labrum: 4 setae at the base of the notch, 1 seta (each side) apically. Fronto-clypeal suture: distinct. Posterior: constricted behind the eyes. Supra-orbital setigerous punctures: 1 pair. Surface: impunctate; microsculpture distinct, isodiametric laterally, elongate medially. Ventral. Mentum: microsculpture distinct, isodiametric; lateral lobes rounded, not margined laterally; tooth absent. Gular sutures: distinct. Palpi: as for the genus. Antennae: I, unisetose; II, with a ring of setae; III–XI, pubescent. THORAX. Dorsal. Pronotum: microsculpture distinct, isodiametric; lateral margins narrowly reflexed, widest in front of middle. Surface: disk, smooth; coarsely punctate area anteriorly (set off by the anterior marginal sulcus) and posteriorly (between the weakly defined basal fovae). Ventral. Prosternum: microsculpture, distinct, isodiametric; intercoxal process weakly margined at apex; coarsely punctate anteriorly and laterally. Proepisternum: microsculpture, distinct, isodiametric; coarse punctures only along sternal-episternal suture. Proepimeron: microsculpture absent, shining; coarsely punctate. Mesosternum: microsculpture present laterally and posteriorly, elongate; coarsely punctate; each side of the anterior median keel declivous; posterior area deeply margined laterally. Mesepisternum: microsculpture, weak if present, shining; sparsely, coarsely punctate. Mesepimeron: microsculpture absent; sparsely, coarsely punctate. Metasternum: anterior margin deeply emarginate; microsculpture present, elongate; coarsely punctate laterally. Metepisternum: microsculpture weak or absent; coarsely punctured. Metepimeron: indistinct. ELYTRA. Microsculpture: distinct on intervals, elongate. Striae: 10 distinct, deeply punctate striae. Disk: asetose. Lateral margins: narrowly reflexed. Epiplura: coarsely and densely punctate. ABDOMEN. Microsculpture: distinct, isodiametric or elongate. Segments: I, coarsely punctate; II–V, coarsely punctate laterally; VI with a few coarse punctures in anterior-lateral angle; IV–VI, with a distinct, deep sulcus just behind each anterior margin. LEGS. Protarsi of males: I, ¾ of ventral surface with squamous setae; II–III, ventral surface with squamous setae. Measurements. Length: 9–10 mm. Width: greatest width across elytra, 4–5 mm. AEDEAGUS (Figs. 6–10). Median lobe: cylindrical, basal lobes ¼ the length of the median lobe. Parameres: elongate, distinctly narrowed distally, asetose. Internal sac: two elongate, parallel scale groups present on dorsal surface (visible through the wall of the median lobe), additional scales and sclerites absent.

Comments. Scaphinotus (*Nomaretus*) *infletus* is similar to *S.* (*Nomaretus*) *fissicollis* in external appearance. The distinct scale groups on the internal sac of the aedeagus of *S. infletus* readily separate it from all other species in the subgenus. The squamous setae on the ventral surface of the first protarsal segment of the males also appears to be a reliable diagnostic character. In *infletus* the setae cover at least ¾ of the ventral surface of the tarsomere, whereas in other species of the genus ½ or less of the ventral surface is covered by these setae.

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Figs. 11–15. Male aedeagi. Figs. 11–14. *Scaphinotus* (*Nomaretus*) *fissicolis*: 11. Right lateral, internal sac not everted. 12. Dorsal, internal sac not everted. 13. Right lateral, internal sac everted. 14. Right lateral, internal sac everted and slightly turned so that the two distinct sclerited are apparent. Fig. 15. *Scaphinotus* (*Nomaretus*) *cavicollis,* right lateral, internal sac everted.

Scaphinotus (*Nomaretus*) *fissicollis* LeConte
Figs. 11–14

Gidaspow (1973) noted in her key to the species of *Nomaretus* that *fissicollis* "usually" has only two lateral pronotal setae. At least one-half of the Arkansas specimens we have examined have three or more setae along the lateral margins. Gidaspow also illustrated the extent of the squamous setae covering the ventral surface of the male protarsal segments of *fissicollis* and *bilobus* Say. The ventral surface of the protarsal segments in males of *fissicollis* more closely resembles the illustrations of *bilobus* than those of *fissicollis* as given by Gidaspow. Utilizing only the pronotal setae and the extent of coverage of the protarsal squamous setae might lead to confusion of Arkansas *fissicollis* and the species *bilobus*. But the aedeagi of the two species are distinctly different. We mention this set of circumstances because *bilobus* has been collected in extreme southern Missouri (Gidaspow, 1973) and may eventually be found in northern Arkansas.

A number of *fissicollis* specimens are deposited in the UAIC, including the following localities: Benton Co. (1 specimen); Franklin Co. (3 specimens); Fulton Co. (1 specimen); Madison Co. (1 specimen); Newton Co. (3 specimens); Stone Co. (2 specimens); Washington Co. (8 specimens).

Scaphinotus (*Nomaretus*) *cavicollis* LeConte
Fig. 15

The coarsely setate pronotum serves to readily identify this species, which is represented by eight specimens in the UAIC. The specimens are from the following localities: Crawford Co. (1 specimen); Polk Co. (1 specimen); Washington Co. (6 specimens). It has been collected in the months of June, September, October and December.

CLADISTIC RELATIONSHIPS IN THE SUBGENUS *NOMARETUS*

Gidaspow (1973) has presented the basic taxonomy of the subgenus *Nomaretus*. The present discussion of cladistic relationships is based on her work and the examination of the three *Nomaretus* species occurring in Arkansas. Plesiomorphic and apomorphic character states were established by outgroup comparison with other taxa in the tribe Cychrini.

Three sets of characters were used in establishing cladistic relationships in *Nomaretus*.

1. Squamous setae on the ventral surface of protarsal segment one of the males. Reductions in the surface covered by these setae is considered an apomorphic state.
2. The number of pronotal setae. Increases in the number of pronotal setae from the plesiomorphic state of two are considered apomorphic.
3. The presence or absence of scale groups and/or sclerites on the internal sac of the aedeagus. An internal sac with no organized scale groups or sclerites would be the plesiomorphic condition. The presence of organized scale groups and/or patterns or the presence of sclerites are considered apomorphic states.

The cladistic relationships among the five known species of *Nomaretus* are depicted in Figure 16. This cladogram represents the most parsimonius interpretation of the three characters given above.

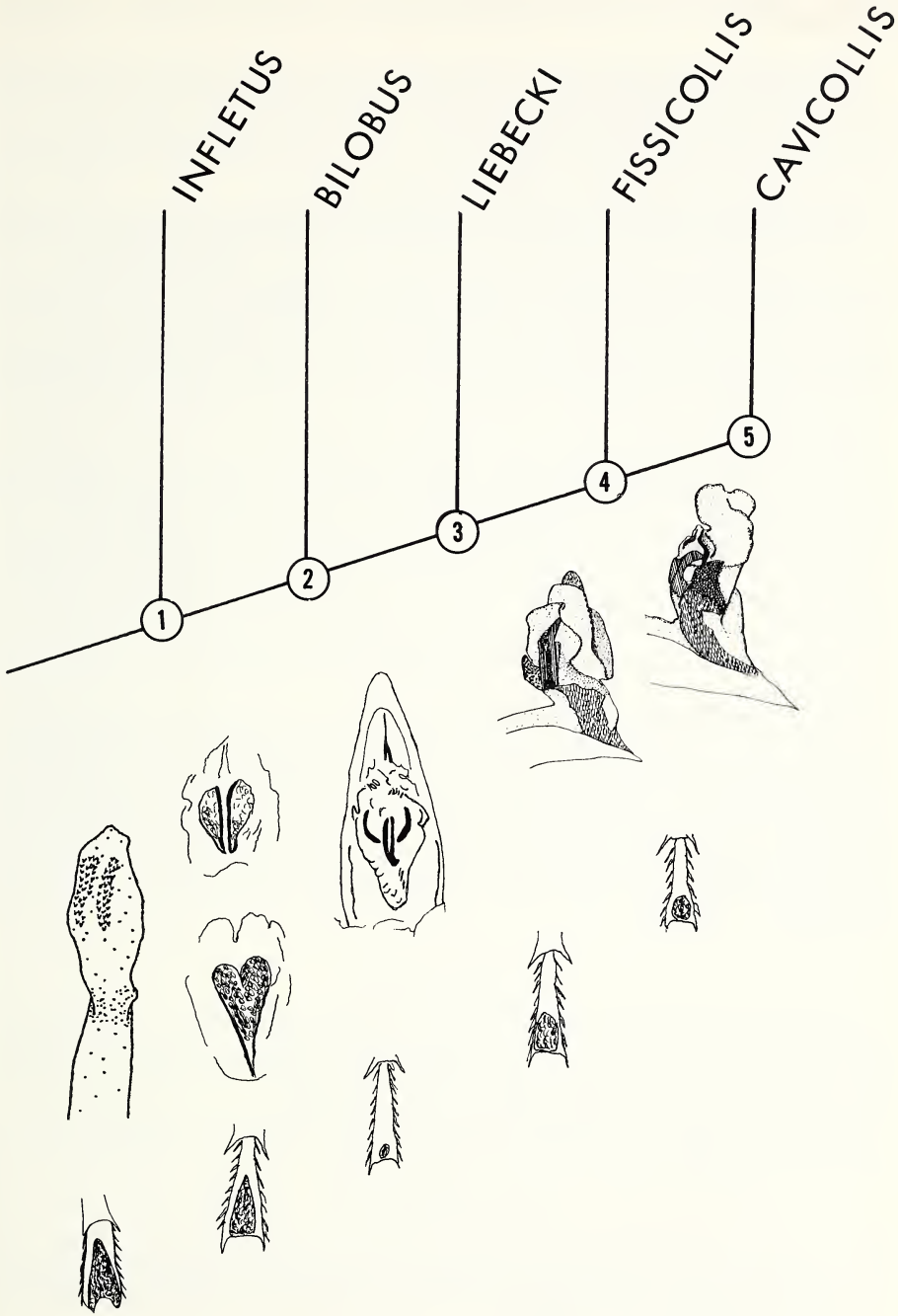

Fig. 16. A proposed cladogram of relationships among the five species in the subgenus *Nomaretus*. The top line of illustrations below the cladogram depicts changes in the armament on the internal sac of the male aedeagus. The bottom line of illustrations depicts changes in the squamous pads on the ventral surface of the male protarsi. See text for further discussion.

Scaphinotus (*Nomaretus*) *infletus* appears to be close to the ancestor that gave rise to the *Nomaretus* lineage. The internal sac of *infletus* is devoid of any sclerites but does have two distinct elongate parallel scale groups. The pronotum has only two or three setae along each lateral margin. The ventral surface of the male protarsal segment one is almost entirely covered by squamous setae.

In the lineage arising from node 1 of the cladogram, the squamae became reduced on the ventral surface or protarsal segment I of the males. This apomorphic character is shared in one state or another by four species in *Nomaretus*. *Scaphinotus* (*Nomaretus*) *bilobus* represents the next stage in the evolution of the *Nomaretus* group. The protarsal squamae are reduced in the males. The internal sac of the aedeagus possesses a peculiar structure on the surface that is not quite a distinct sclerite nor a distinct scale group. The lateral margins of the pronotum are beset with more than two pair of setae.

The next apomorphic changes to occur were a continued reduction in the squamae on the male protarsal segments (in two species, *liebecki* Van Dyke and *cavicollis*) and the development of distinct sclerotized structures on the surface of the internal sac of the aedeagus. *Scaphinotus* (*Nomaretus*) *liebecki* appears to represent the first step in the development of the aedeagal sclerotized structures. These sclerotized structures apparently became larger and more robust in *fissicollis* and subsequently fused into one structure in *cavicollis*. The anterior portion of the pronotum in *cavicollis* is beset with numerous setiferous punctures in addition to the numerous setae along the lateral margins.

At present no proposals can be offered regarding the historical events that gave rise to the isolation and subsequent speciation in *Nomaretus* populations. Four species of *Nomaretus* have overlapping ranges in the Ozark uplift area: *fissicollis, cavicollis, bilobus* and *infletus*. The fifth species, *liebecki*, occurs only a short distance south (Louisiana, Texas) of *cavicollis* populations in the Ouachita mountain uplift area. Perhaps the subgenus *Nomaretus* represents a taxonomic group whose evolution will eventually be closely associated with the geological history of the Ozark and Ouachita mountains.

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